CLAIMS

1. A method of in-situ measurement of optical aberrations, the method comprising:

producing an illumination source at low partial coherence and chief rays overfilling an entrance pupil;

exposing measurement fiducials of an encoded face of an optical element onto a sensing plane;

measuring relative positions of the exposed measurement fiducials on the sensing plane; and

determining the optical aberration from the measured positions and known relative positions of the measurement fiducials of the encoded face.

2. A method as defined in Claim 1, wherein the optical element is a refractive lens.

3. A method as defined in Claim 1, wherein the optical element is a conical lens.

4. A method as defined in Claim 1, wherein the optical element is a diffractive optic.

5. A method as defined in Claim 1, wherein the optical element is a compound lens.

6. A method as defined in Claim 1, wherein the optical element is an aperture.

7. A method as defined in Claim 1, wherein the measurement fiducials are scanner wafer alignment marks.

8. A method as defined in Claim 1, wherein the measurement fiducials are stepper wafer alignment marks.

9. A method as defined in Claim 1, wherein the measurement fiducials are square toruses.

10. A method as defined in Claim 1, wherein the measurement fiducials are crosses.

11. A method as defined in Claim 1, wherein the measurement fiducials include subresolution features to thereby produce a gradient in transmission.

12. A method as defined in Claim 1, wherein producing a light source at low partial coherence further comprises providing an illumination modifying optic.

13. A method as defined in Claim 12, wherein the illumination modifying optic is an opaque disk with a hole in it wherein the illumination modifying optic is placed at the conjugate aperture stop of a projection lithography tool.

14. A method as defined in Claim 12, wherein the Illumination modifying optic is a diffuser.

15. A method of measuring lens aberrations of a projection lens system, the method comprising:

directing a plurality of light ray bundles, each light ray bundle includes a chief ray, onto a plurality of locations on a reticle with a plurality of measurement fiducials encoded onto a face of the reticle, wherein the chief ray angles incident at the plurality of locations on the reticle differ;

exposing the plurality of measurement fiducials through a lens and onto a sensing plane;

measuring positions of the plurality of exposed measurement fiducials on the sensing plane; and

determining aberrations of the exposed measurement fiducials.

16. A method as defined in Claim 15, wherein producing a plurality of light ray bundles at desired locations further comprises:

inserting an illumination modifying optic between a light source and a condensing lens thereby forming an effective source, wherein the illumination modifying optic is located at a conjugate aperture stop of an image plane of the projection lens system, wherein light passing through the illumination modifying optic and condensing lens forms a plurality of light ray bundles with corresponding chief rays; and

placing an optical element between the effective source and an encoded face, wherein angles of incident of the chief rays within the respective bundles vary sufficiently to overfill a pupil of the optical element.

17. A method as defined in Claim 16, wherein the optical element is a lens.

18. An illumination source comprising:

a light source;

a condensing lens configured to accept light from the light source;

an illumination modifying optic between the light source and the condensing lens, wherein the illumination modifying optic is located at a conjugate aperture stop of an image plane of a projection lens system, wherein the illumination modifying optic is configured such that light from the light source that passes through the illumination modifying optic and condensing lens forms a plurality of light ray bundles with corresponding chief rays; and

placing a lens on a side of the condensing lens opposite from the illumination modifying optic, wherein angles of incidence of the chief rays within the respective light ray bundles onto the lens vary sufficiently to overfill the lens pupil.

19. An illumination source as defined in Claim 18, wherein the illumination modifying optic comprise an opaque disk with a hole in it.

20. An illumination source as defined in Claim 18, wherein the illumination modifying optic is a diffuser.

21. A method as defined in Claim 18, wherein the lens is a refractive lens.

22. A method as defined in Claim 18, wherein the lens is a conical lens.

23. A method as defined in Claim 18, wherein the lens is a diffractive optic.

24. A method as defined in Claim 18, wherein the lens is a compound lens.

25. An effective light source comprising:

a light source;

a condensing lens configured to accept light from the light source; and

an illumination modifying optic between the light source and the condensing lens, wherein the illumination modifying optic is located at a conjugate aperture stop of an image plane of a projection lens system, and the illumination modifying optic is configured such that light from the light source that passes through the illumination modifying optic and condensing lens forms a plurality of light ray bundles with corresponding chief rays.

26. An illumination source as defined in Claim 25, wherein the illumination modifying optic comprise an opaque disk with a hole in it.

27. An illumination source as defined in Claim 25, wherein the illumination modifying optic is a diffuser.

28. A reticle comprising:

an array of field points, wherein each field point comprises an array of fiducials; and

an array of optical elements, wherein an optical element is associated with each of the field points.

29. A reticle as defined in Claim 28, wherein the optical element is a refractive lens.

30. A reticle as defined in Claim 28, wherein the optical element is a conical lens.

31. A reticle as defined in Claim 28, wherein the optical element is a diffractive optic.

32. A reticle as defined in Claim 28, wherein the optical element is a compound lens.

33. A reticle as defined in Claim 28, wherein the fiducials are scanner wafer alignment marks.

34. A reticle as defined in Claim 28, wherein the fiducials are stepper wafer alignment marks.

35. A reticle as defined in Claim 28, wherein the fiducials are square toruses.

36. A reticle as defined in Claim 28, wherein the fiducials are crosses.

37. A reticle as defined in Claim 28, wherein the fiducials include subresolution features to thereby produce a gradient in transmission.

38. A projection lithography tool comprising:

an effective light source comprising

a light source;

a condensing lens configure to accept light from the light source; and

an illumination modifying optic between the light source and the condensing lens, wherein the illumination modifying optic is located at a conjugate aperture stop of an image plane of a projection lens system, the illumination modifying optic is configured such that light from the light source that passes through the illumination modifying optic and condensing lens forms a plurality of light ray bundles with corresponding chief rays;

a reticle upon which the light ray bundles are projected, the reticle comprising:

an array of field points, wherein each field point comprises an array of fiducials; and

an array of optical elements , wherein an optical element is associated with each of the field points; and

an upper lens group wherein the conjugate aperture stop is imaged by the combination of the condenser lens and the upper lens group onto an aperture stop, the upper lens group further including optics to image the fiducials onto a sensing plane.

39. A projection lithography tool as defined in Claim 38, wherein the optical element is a refractive lens.

40. A projection lithography tool as defined in Claim 38, wherein the optical element is a conical lens.

41. A projection lithography tool as defined in Claim 38, wherein the optical element is a diffractive optic.

42. A projection lithography tool as defined in Claim 38, wherein the optical element is a compound lens.

43. A projection lithography tool as defined in Claim 38, wherein the measurement fiducials are scanner wafer alignment marks.

44. A projection lithography tool as defined in Claim 38, wherein the measurement fiducials are stepper wafer alignment marks.

45. A projection lithography tool as defined in Claim 38, wherein the measurement fiducials are square toruses.

46. A projection lithography tool as defined in Claim 38, wherein the measurement fiducials are crosses.

47. A projection lithography tool as defined in Claim 38, wherein the measurement fiducials include subresolution features to thereby produce a gradient in transmission.

48. A projection lithography tool as defined in Claim 38, wherein the illumination modifying optic is an opaque disk with a hole in it.

49. A projection lithography tool as defined in Claim 38, wherein the illumination modifying optic is a diffuser.